

# WHAT IS CLAIMED IS

1. A flame-retardant polyester fiber comprising a phosphorus compound copolymerized polyester satisfying the following formulas (1)-(3) and having a phosphorus atom content of 500-50,000 ppm:

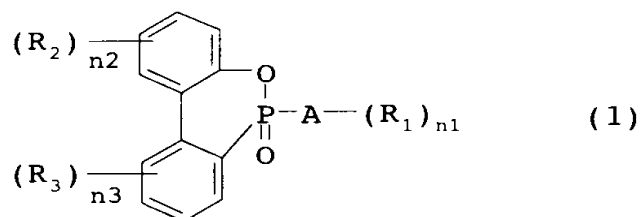
$$\tan \delta_{\max} \geq 0.1740 \quad (\text{formula 1})$$

$$T\alpha - 3.77 \times \ln (\text{dtpf}) \leq 137.0 \quad (\text{formula 2})$$

$$1.331 \leq SG - \frac{\sqrt{\Delta n}}{8.64} \leq 1.345 \quad (\text{formula 3})$$

wherein  $\tan \delta_{\max}$  is a maximum value of loss tangent in a dynamic viscoelasticity measurement,  $T\alpha$  is a temperature at which loss tangent reaches the maximum, dtpf is single fiber fineness (dtex), SG is density ( $\text{g}/\text{cm}^3$ ), and  $\Delta n$  is birefringence.

2. The flame-retardant polyester fiber of claim 1, which comprises a copolymerized polyester obtained by adding a phosphorus compound of the following formula (1):



wherein  $R_1$  is a monovalent ester-forming functional group,  $R_2$  and  $R_3$  are the same or different and each is selected from a halogen atom, a hydrocarbon group having 1 to 10 carbon atoms and  $R_1$ , A is a divalent or trivalent organic residue,  $n1$  is 1 or 2 and  $n2$  and  $n3$  are each an integer of 0 to 4.

3. The flame-retardant polyester fiber of claim 1, which is characterized by not less than 6500 times up to an occurrence of cutting by abrasion under a load of 0.098 N/tex in a yarn abrasion test.

4. The flame-retardant polyester fiber of claim 1, which shows a tensile elongation at break (DE) of 20-50%.

5 5. The flame-retardant polyester fiber of claim 1, which shows a shrinkage in hot water (SHW) of not more than 10%.

6. The flame-retardant polyester fiber of claim 1, which satisfies the following formula 4, wherein a L value is not less  
10 than 67 and a b value is not more than 10.00 as measured with a Hunter's color-difference meter:

$$\%B.B. < 0.5 \quad (\text{formula 4})$$

wherein %B.B. is a proportion of ester bond broken upon immersion in a closed system in pure water at 130°C for 6 h,  
15 which can be determined by the following formula (5) wherein an intrinsic viscosity before immersion is  $[\eta]_i$  and that after immersion is  $[\eta]_f$ , and the intrinsic viscosity is determined in a mixed solvent of phenol/1,1,2,2-tetrachloroethane (weight ratio 3/2) at 30°C:

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$$\%B.B. = 0.244 \times \{[\eta]_f^{-1.471} - [\eta]_i^{-1.471}\} \quad (\text{formula 5}).$$

7. The flame-retardant polyester fiber of claim 1, wherein the phosphorus compound copolymerized polyester comprises an organic  
25 fluorescent brightener in a proportion of 0.01-1 wt% and, as a condensation polymerization catalyst, an antimony compound, a germanium compound and a cobalt compound in amounts that simultaneously satisfy the following formulas (6)-(9):

$$30 \leq S \leq 400 \quad (\text{formula 6})$$

30  $10 \leq G \leq 100 \quad (\text{formula 7})$

$$5 \leq C \leq 40 \quad (\text{formula 8})$$

$$200 \leq S+2G+C \leq 400 \quad (\text{formula 9})$$

wherein S, G and C are each a content (ppm) of an antimony atom, germanium atom or cobalt atom relative to the polyester.

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8. A flame-retardant polyester woven, knitted fabric comprising the flame-retardant polyester fiber of claim 1 at least in a part thereof.

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9. A suede raised woven, knitted fabric, which is a raised woven, knitted fabric comprising the flame-retardant polyester woven, knitted fabric of claim 8 that underwent a raising treatment, and which shows a coefficient of friction of a surface of the  
10 woven, knitted fabric by a surface tester KES-FB4 of 0.200-0.300.

10. A flame-retardant polyester raised warp knitted fabric, which is a raised woven, knitted fabric comprising the flame-retardant polyester woven, knitted fabric of claim 8 that  
15 underwent a raising treatment, and which shows an after-flame time of not more than 3 sec as measured by the following test method:

a flame of a lighter is drawn up to a bottom end of a specimen (1.5 cm x 20 cm) stood vertically and the flame  
20 is drawn back when the specimen is inflamed, along with which the after-flame time of the specimen is measured.

11. A flame-retardant polyester nonwoven fabric comprising the flame-retardant polyester fiber of claim 1 at least in a part  
25 thereof.